Fresnel's Diffraction
(Optics)

e-content for B.Sc Physics (Honours)

B.Sc Part-II
Paper-III

Dr. Ayan Mukherjee,
Assistant Professor,
Department of Physics,
Ram Ratan Singh College, Mokama.
Patliputra University, Patna

Fresnel Diffraction.

Bending of waves around the edges of an obstacle is called diffraction & dimensions of obstacles comparable to wavelength of waves.

Difference b/w interference & Diffraction

Interference	Diffraction
1. Interference is the result of interaction of light coming from different wave fronts originating from the source.	1. Diffraction is the result of interaction of light coming from different parts of same wavefront.
2. Interference fringes may or may not be of the same width.	2. Diffraction fringes are not of the same width.
3. Region of minimum intensity are perfectly dark.	3. Regions of minimum intensity are not perfectly dark.
4. All bright bands are of same intensity.	4. The different maxima are of varying intensities with max. intensity for central maxima.

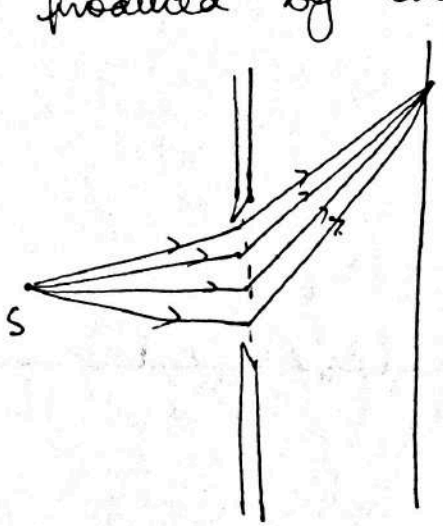
Fresnel Diffraction :- Source of light & the screen are effectively at finite distances from the obstacle.

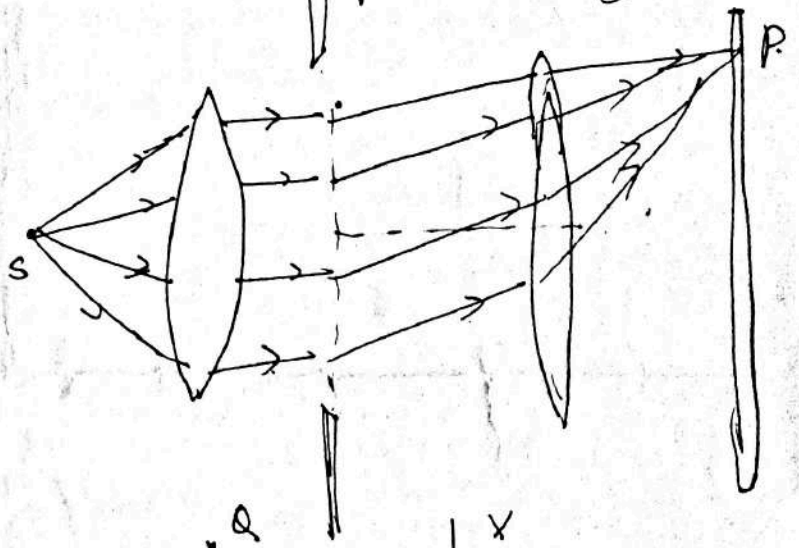
∴ observation of Fresnel diffraction does not require any lenses ∴ incident wave front is not planar

∴ the phase of secondary wavelets is not the same at all points in the plane of the obstacle.

The resultant amplitude at any point of the screen is obtained by the mutual interference of secondary wavelets from different elements of unblocked portions of wave front.

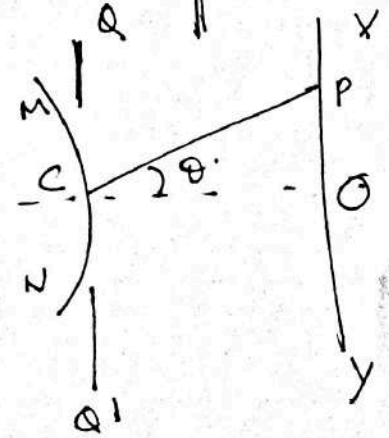
Fraunhoffer Diffraction. Source of light & screen are effectively at infinite distances from the obstacle. Here lenses are used ∴ the diffraction is produced by the interference between parallel rays. Screen





Fresnel.

Fresnel's assumptions.



1) A wave front can be divided into a large no. of strips or zones called Fresnel's zones of small area and the resultant effect at any point will depend on the combined effect of all the secondary waves emanating from the various zones.

2) The effect at a point due to any particular zone will depend on the distance of the point from the zone.

3) The effect at P will also depend on the obliquity of the point with reference to the zone under consideration.

Due to C → max. at 0 & ↓ with ↑ obliquity.

The effect at a point due to obliquity factor is proportional to $(1+\cos\theta)$ for C.

Along C1 → max

Along CS → $\theta = 90^\circ \rightarrow$ 1/2 of what it is at 0.

at $180^\circ \rightarrow$ 0 ∴ no back waves.